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The link between renewable energy production and gross domestic product in Africa: A comparative study between 1980 and 2008

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ABSTRACT

Renewable energy (RE) projects are arguably one of the most important strategies that can be used in the mitigation of climate change impacts. At the same time, RE technologies can generate clean energy and potentially boost the economy of the African continent. It is thus not surprising that recent studies have investigated the relationship between RE and economic growth in some African countries. However, the limitation of these reductionist analytical frameworks is that they can conceal the true regional picture in terms of the link between investments in RE technologies and gross domestic product (GDP). This holistic analysis is important in order to inform regional policies on climate change. The article uses statistical analytic techniques to examine the correlation between RE production and economic growth across different blocks of the African continent between 1980 and 2008. The analysis is between geographical blocks (e.g. Southern Africa, Western Africa, etc.) and between oil and non-oil producing blocks. Generally speaking, while there exists a similar pattern in all the studied blocks in terms of mean, standard deviation and correlation between RE and GDP, a few exceptions can be found. For instance, the rise in RE–GDP correlation from 1992/1993 onwards was conspicuously higher in North Africa and oil-producing countries compared to all the other blocks. Similarly, Southern Africa was the only block where the correlation between RE and GDP was negative throughout the period under review, except 1988, 1989 and 1997 when it was positive.

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1. Background

In the past three decades, the developed countries have been lobbying the developing countries to be part of the global environmental agenda by scaling up the adoption of strategies that seek to address impacts of climate change. This has been echoed in many international reports and at many conferences. Some examples include the Stern report [1] and the United Nations climate change conferences like the ones held in Copenhagen, Denmark (COP 15), Cancun, Mexico (COP 16) and Durban, South Africa (COP 17). These conferences were held between 7–18 December 2009, 29 November–10 December 2010 and 28 November–9 December 2011 respectively. One of the motivations to this global 'climate change movement' has been the growing environmental concerns as a result of greenhouse gas emissions from natural and anthropogenic activities that have enormous negative effects on the ozone

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layers [2,3]. Another major concern is the issue of energy security. Global oil wells are running out and the growing need for energy to run national economies is increasing at an alarming rate [4].

RE technologies, or the exploitation of RE sources, are one of the most widespread and recommended strategies to mitigate impacts of climate change [5–7]. This has been echoed in most reports with the Stern's report recommending that there should be a system that can facilitate the transfer of RE technologies to developing countries. Furthermore, through the clean development mechanisms, RE projects as in the case of carbon sinks have been recommended as a means to sequester or limit the production of greenhouse gases [7,8]. Also, the developing countries have recently received increased financial support from developed nations to help them effectively deal with climate change related issues [9,10]. This practice is likely to continue as climate finance was one of the main items on the agenda of COP 17 in Durban [11].

Despite all these promising initiatives, some of the developing countries have had mixed opinions in terms of who the real beneficiaries of these global climate change strategies are [12]. As a result of these doubts, some countries have openly been very reluctant to join the West in the fight against climate change. The developing countries have argued that the financial package being offered by the West is too small to fight climate change. Addressing heads of African states at the ad hoc pre-COP 15 meeting held at Bella Centre, Copenhagen, Lumumba Di-Aping, Sudanese chief climate negotiator and representative of the G77 countries, wept as he spoke of the unfairness surrounding the climate change negotiation process between developed and developing nations [13]. Commenting on the proposed US$10 billion climate change financial assistance from developed to developing nations, Di-Aping called the deal a "suicide pact", with the $10 billion being "not [even] enough to buy us coffins". Also, there is evidence to suggest that whereas the concern of the developed countries and the international community appears to be on climate change, the priorities of developing countries lies elsewhere. Indeed, the developing countries have often claimed to have too many other pressing issues to deal with – such as chronic poverty, corruption/governance, disease, and HIV/AIDS [14]. Many in the developing countries live in emergency conditions and the risk of diversifying or abandoning a "business-as-usual" conventional energy source to a RE source is too high. In a nutshell, it is not uncommon to find that environmental concerns are not a top agenda item for most developing countries. This is mirrored in studies about environmental poverty where some countries tend to adopt "grow first, clean up later" approach [15].

The real questions to be addressed, therefore, include: by embarking on RE to address environmental impacts, can the developing countries in Africa improve upon the living conditions of their population? In other words, what are the benefits of these technologies in terms of economic development? Is the opportunity cost too great? Is the financial support offered by the West enough as a benefit? These questions can be addressed if the relationship between the production of RE and economic development is well-understood. However, recent studies have attempted to clarify the relationship between RE production and other economic indicators. For example, Chien and Hu [5] have used the structural equation modelling (SEM) to assess the effect of RE on GDP. Their conclusion was that RE had a positive effect on GDP but only on capital formation. For other examples see [16–26]. While some of the results from these studies have indicated clear correlations between the investigated indicators, others have been mixed [23,27]. Furthermore, most of these studies have focused on transition economies and developed countries, particularly the Organization for Economic Co-operation and Development (OECD) countries. The very few studies that have been conducted on Africa have focused on selected few countries, while others have focused on the link between energy *consumption* (and not production) and GDP (for example see [28]). Akinlo [29], Odhiambo [30], Odhiambo [31], Esso [28] and Squalli [32] have investigated the link between energy consumption and economic growth in Nigeria, Tanzania, South Africa, selected 7 other African countries, and the Organization of the Petroleum Exporting Countries (OPEC) respectively. It is important to note that the countries from Africa in the latter study on OPEC countries included only Nigeria, Algeria and Lybia. The four most extensive studies so far on Africa on the relationship between energy consumption and economic growth are Chontanawat et al. [33], Kebede et al. [34], Wolde-Rufael [35] and Wolde-Rufael [36]. The studies covered 21, 20, 19 and 17 African countries respectively, although some countries were covered by one or more studies. Chien and Hu's [5] research on the effect of RE on GDP also included only 21 African countries, although the majority (95) were non-African.

Although these studies on African countries are elaborate, and indicate clear relationships between indicators, some have been mixed. For example, studies by Wolde-Rufael [35] revealed that there was a long run relationship between energy use per capita and per capita real gross domestic product for eight countries and no relationship and causality for ten countries. Also, these studies tend to focus on single countries and do not bring out a global picture of Africa. This can easily eclipse real problems that may require responses that rely on international policy perspectives. It was against this backdrop that Chontanawat et al. [33] conducted their research in which the causality between energy and GDP of a block of 30 OECD and 78 non-OECD countries were investigated. From a global perspective, rather than a reduction approach or individual countries perspective, the major finding was that causality from aggregate energy consumption to GDP and GDP to energy consumption was found to be more prevalent in the block of developed OECD countries compared to the developing non-OECD countries. From a policy perspective, this implies that a policy to reduce energy consumption aimed at reducing emissions is likely to have greater impact on the GDP of the developed world rather than the developing world. Chien and Hu [5] also adopted a global approach when they looked at 116 countries (21 from Africa) to assess the effect of RE on GDP.

Given that the African continent is divided into distinct widely diversified blocks using geographical, oil producing, and economic criteria among others, we believe there is a need to conduct similar holistic studies across the different blocks in the continent. This is mainly because the differences between these blocks are too great for a "one-size-fits all" policy to be applicable to the different blocks. For example, Nigeria in West Africa that produces about 2.2 million barrels of oil a day [37] may be reluctant in international climate change policies to consume renewable energy while Zambia, a Southern African country without a single oil reserve, may have no alternative but embrace policies that can lead to the uptake of RE. We believe the 'blocks' approach we have adopted herein can potentially provide guidelines to policy makers to design environmental, energy and economic policies that can be applicable to individual African regions.

In a study involving a continent with at least 53 countries, it is impossible to address all the economic and environmental indicators. Hence, we will focus on RE production and GDP. Furthermore, within the scope of this study, the geographical and oil distribution criteria will be considered. The rationale for this choice is that the criteria clearly distinguish each block from each other. Based on the geographical criterion, the partition according to the United Nations geoscheme will be used. This is the most elaborate scheme that partitions continents into macro-geographical and sub-regions developed by the United Nations Statistics Division [38]. The United Nations geoscheme partitions Africa on the following geographical lines: North Africa, West Africa, Central Africa, East Africa and Southern Africa. The list of countries in these different geographical

blocks can be found in Appendix A. The second criterion using oil production is based on studies by BP Statistical Energy Survey [39]. According to this survey five countries dominate Africa's upstream production and accounts for 85% of the continent's oil production. The five countries are Nigeria, Libya, Algeria, Egypt and Angola. In this article, these countries were considered as one block called 'oil producing block'. The rest of the continent was grouped into another block called 'non-oil producing block' although countries like Gabon, Congo, Cameroon, Tunisia, Equatorial Guinea, the Democratic Republic of the Congo, and Cote d'Ivoire are minor oil producers. The complete list of countries included in these blocks is in Appendix A. Statistical techniques were applied to discover the relationship across the different blocks.

2. Data and methodology

In this study data from two different sources were used. Data about RE production were obtained from International Energy Annual (IEA) [37] while the gross domestic product (GDP) data were obtained from the World Bank development indicator database [40]. The RE production units were million kilowatthours while the GDP were billion US dollars. The different RE considered include hydroelectric, geothermal, wind, solar, tidal, wave, biomass and waste energy. The sample period chosen include 1980–2008. Although some data for other years exist, the sample period size was chosen so as to avoid the period of the political upheavals in the Middle East and North Africa. This is simply because of the effects it might have had on the production of renewable energy.

Three methodological steps were pursued to explore and establish the relationship between renewable energy production and GDP and to predict the effects of the former on the latter. Firstly, a time series and descriptive statistics such as the mean, standard deviation (SDV), skewness and kurtosis are used for each of the two time series in order to depict the trend in the two estimated variables over the sample period. Secondly, a bivariate correlation analysis is conducted to have a preliminary understanding of the nature of the relationship between the renewable energy production and GDP. The Pearson product–moment correlation was used. Thirdly, the regression analysis enabled us to examine explanatory power of predictor variables and to find evidence of auto-correlated residuals from Durbin–Watson (D–W) statistic.

3. Results and analytical discussion

3.1. Time series representation

The overall trend for RE production has a similar pattern for all the blocks over the entire sample period of 1980–2008. Although the overall pattern is approximately the same for all the regions, the non-oil producing block produced the highest RE in all the years between 1980 and 2008, which appears as a translation or shift above all the other trends for the different regions. The implication of this is that it is easier to apply a single forecasting model on RE production for all the regions which can be used in prediction purposes. It must however be noted that although the non-oil producing block is leading, it is simply because the group contains the largest number of countries compared to the other blocks, hence bringing in the need to consider GDP and RE production per capita.

The pattern of the trends for the GDP for all the different blocks is similar to that of RE production between 1980 and 2002, where a sudden rise in GDP is noticed till 2008. Furthermore, like in RE production, the GDP for non-oil producing countries is higher than for each of all the other regions between 1980 and 2008. Given the general similar trend of the GDP for the different blocks, a single forecasting model can be developed for all the different blocks.

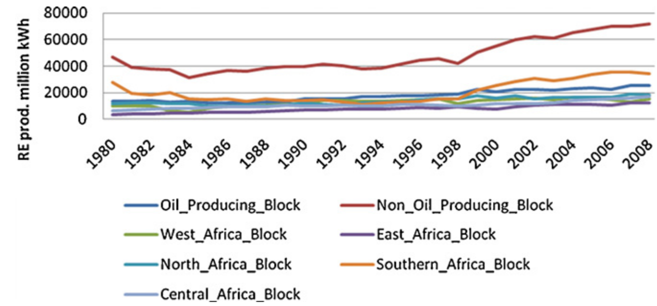

Fig. 1. Trend of regional RE production. *Description*: The figure depicts the time series of renewable energy (RE) production of the different blocks of the African continent over the sample period from 1980 to 2008.

However, given the changing nature of the GDP trends (i.e. made up of the "gentle" part between 1980 and 2002 and a steeper part between 2002 and 2008), the forecasting model for GDP is likely to be more complex than that for the RE production.

3.2. Mean and SDV of RE production and GDP

The mean and SDV for the blocks under review have been calculated for RE production and GDP for the sample period 1980–2008. To obtain an indication of their variation, the mean and SDV were graphically represented in Figs. 3–6.

The overall pattern of the mean of RE production depicted in Fig. 3 is similar to that of the RE production in Fig. 1. However, while the RE production trend for non-oil producing block was dominant in Fig. 1, in Fig. 3, the dominant mean RE production trend is the oil-producing block. This difference comes as a result of the difference in the number of countries belonging to a block. For example, the mean RE production for the oil producing block is the total RE produced annually between 1980 and 2008 divided by the number of countries (5) while the mean RE production for the non-oil producing block is equally the total RE produced annually between 1980 and 2008 divided by 48 (the number of countries in the block) (see Appendix A).

The mean variation of GDP depicted in Fig. 4 is similar to the pattern of the GDP trend of Fig. 2. However, as in the mean RE production, the oil producing block has the dominant mean GDP while non-oil producing block is the dominant in Fig. 2.

The trends for the SDV for all the blocks have a gentle pattern over the sample period except that of the Southern Africa block, where there is a sudden fall and rise in the ranges 1980–1988 and 1998–2008 respectively. Furthermore, the trend for the oil producing block and the north Africa block have an identical pattern except for a marginal change between the two blocks along the *y*-axis. This is expected given that three of the north African block countries are also members of the block of the oil-producing block.

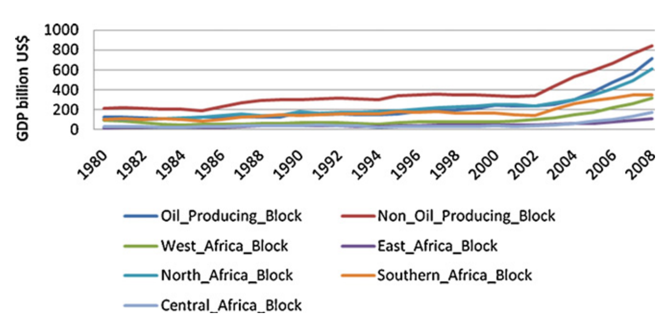

Fig. 2. Trend of regional GDP. *Description*: The figure depicts the time series of gross domestic product (GDP) of the different blocks of the African continent over the sample period from 1980 to 2008.

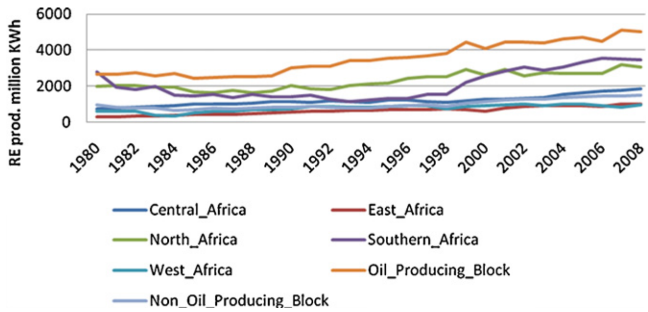

Fig. 3. Annual mean variation of RE production. *Description*: The figure depicts the annual mean of the RE production of the different blocks of the African continent over the sample period from 1980 to 2008.

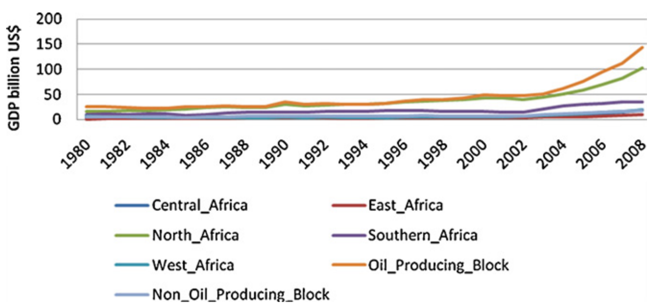

Fig. 4. Annual mean variation of GDP. *Description*: The figure depicts the annual mean of the GDP of the different blocks of the African continent over the sample period from 1980 to 2008.

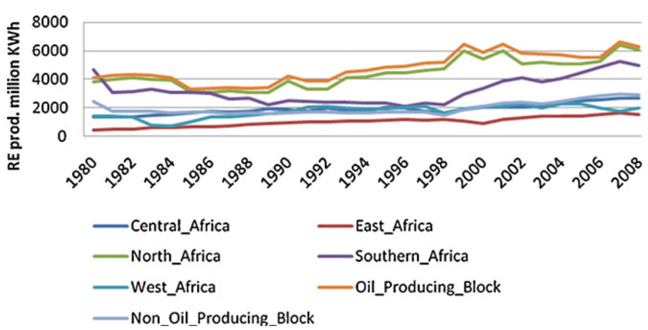

Fig. 5. Annual SDV variation of RE production. *Description*: The figure depicts the annual standard deviation (SDV) of the RE production of the different blocks of the African continent over the sample period from 1980 to 2008.

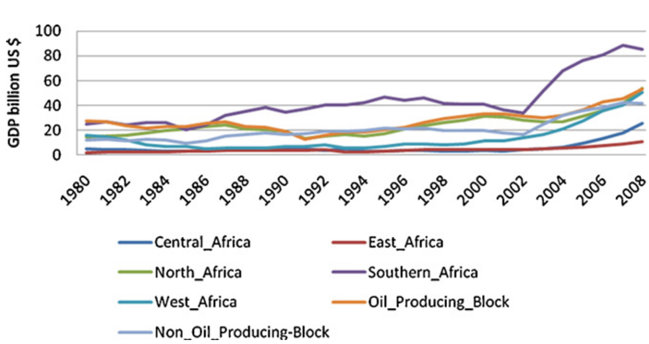

Fig. 6. Annual SDV variation of GDP. *Description*: The figure depicts the annual standard deviation (SDV) of the GDP of the different blocks of the African continent over the sample period from 1980 to 2008.

The SDV of GDP over the sample period maintains a general pattern similar to the GDP trend found in Fig. 2. However, while most of the trends in Fig. 2 experienced a big jump from 2002, with non-oil producing block leading in the jump, only the Southern African block demonstrates a real jump in SDV variation in Fig. 6 from 2002. Other blocks have a very mild rise in their slope from 2002/2003 to 2008.

3.3. Skewness and kurtosis of RE production and GDP

Skewness measures the asymmetry of a data distribution while kurtosis indicates the pointedness of the shape of the distribution. When a distribution contains more relatively large values than relatively small values then it is negatively skewed. In contrast, when a distribution contains relatively small values than relatively large values it is positively skewed. In other words, when a symmetry corresponds to a skewness of zero, a positive or negative value then the distribution is said to be positively and negatively skewed respectively [41]:

$$\begin{aligned}&\text{Statistically, for a very large sample,}\\&\text{Significant departure from symmetry} \Leftrightarrow |\text{skewness}| > 1.96 *\\&\text{Standard error of skewness}\end{aligned} \quad (1)$$

Similarly, a positive value for the kurtosis is associated with a more pointed distribution while a negative value is associated with a flatter distribution:

$$\begin{aligned}&\text{Statistically, for a very large sample,}\\&\text{Kurtosis is significantly different from zero} \Leftrightarrow |\text{kurtosis}|\\&> 1.96 * \text{Standard error of kurtosis}\end{aligned} \quad (2)$$

In Eqs. (1) and (2), the $||$ represents the absolute value sign. The determination of the equations has been examined in existing literature (e.g. [41]), hence it will not be duplicated in this article. In order to apply Eqs. (1) and (2), the skewness and kurtosis and their respective standard errors for both RE production and GDP for the different African regions were calculated. The standard errors of skewness and kurtosis of RE production for all the regions were 0.434 and 0.845 respectively. Similarly, the standard errors of skewness and kurtosis for GDP for all the regions were 0.434 and 0.845 respectively. The values for the skewness and kurtosis for the different regions are summarised in Table 1.

From Table 1 on RE production data from 1980 to 2008, all the regions except West Africa were positively skewed. However, on applying Eq. (1), none of the skewness was significant for all the regions with regards to RE production as Eq. (1) was not satisfied in any case. With regards to kurtosis, all except West and Central Africa have negative kurtosis for RE production i.e. flatter distribution for other blocks and sharper distribution for West and Central Africa respectively. However, none have kurtosis that is significantly different from zero as Eq. (2) was not satisfied in any case. On the other hand, the GDP is positively skewed in all the regions.

Table 1
Pattern distribution of the RE production and GDP over 1980–2008.

Regions	RE		GDP	
	Skewness	Kurtosis	Skewness	Kurtosis
Oil-producing block	0.311	−1.342	2.220	4.928
Non-oil producing block	0.784	−0.888	1.647	2.268
West Africa	−0.847	0.072	2.187	4.332
East Africa	0.100	−1.008	1.511	2.783
North Africa	0.300	−1.194	1.775	3.483
Southern Africa	0.655	−1.178	1.356	1.022
Central Africa	0.767	0.352	2.592	6.707

Description: The table depicts the variation of the patterns (i.e. skewness and kurtosis) for the different regional blocks of the African continent.

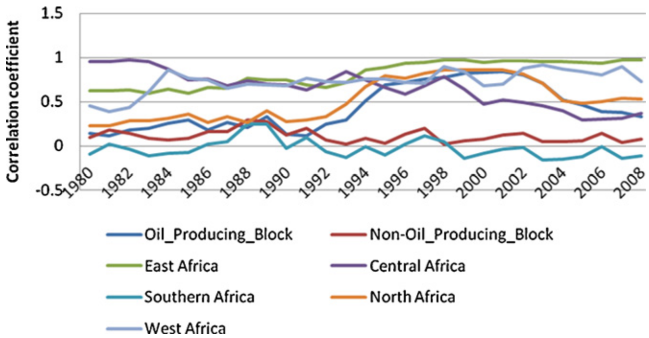

Fig. 7. Correlation coefficient variation between RE production and GDP. *Description*: The figure depicts the correlation between the RE production and GDP of the different blocks of the African continent over the sample period from 1980 to 2008.

However, like the RE production, none of the skewness was significant as Eq. (1) has not been satisfied. Similarly, the kurtosis of the GDP for all the regions is positive, i.e. their distributions are associated with a more pointed shape. Similarly, unlike in the RE production, the kurtosis is significantly different from zero except Southern Africa where Eq. (2) is not satisfied.

3.4. Bivariate correlation analysis

In this section the correlation between the RE production and GDP for all the blocks over the sample period was calculated and presented as in Fig. 7.

From Fig. 7, all the correlation coefficients are positive except Southern Africa with negative correlations for about 70% of its data. The pattern for the correlations is similar in the different blocks except for oil producing and north Africa where there is a sudden jump from 1992/1993 onwards. A drop in the correlations can also be noticed for three different blocks, i.e. Central, Southern and non-oil producing countries with Central Africa experiencing the highest drop.

In the preceding paragraphs, the general trends for the mean and SDV of RE production and GDP were examined. To understand the relationship between the RE production and GDP, the trend of the correlation between both has also been examined. However, to make a clear cut distinction, the overall means and SDVs over the whole sample period for RE production and GDP have been computed and presented in Table 2.

The correlations between GDP and RE production in the oil and non-oil producing countries are in the same order (i.e. >0.8). Similarly, on the basis of geographical distribution, three blocks – East, North and Central Africa, exhibit correlations of the same order (i.e. >0.8) as those of oil and non-oil producing countries. However, while the correlation between GDP and RE production in Southern Africa is 0.7, lower compared to those of oil, non-oil, East, North and Central Africa countries, the correlation between GDP and RE production in West Africa is the lowest at 0.433. Nonetheless, it can be concluded that there is a strong significantly positive relationship between GDP and RE production in all the different blocks except in West Africa where the relationship is moderately significant.

Table 3
Autocorrelation results of RE production and GDP.

Region	GDP	RE	Lag
Oil producing block	0.733	0.889	1
Non-oil producing block	0.802	0.900	1
West Africa	0.762	0.839	1
East Africa	0.747	0.871	1
North Africa	0.751	0.851	1
Southern Africa	0.841	0.879	1
Central Africa	0.693	0.820	1

Description: The table depicts the regional variations of the autocorrelation coefficients of the RE production and GDP over the sample period 1980–2008.

3.5. Regression analysis

Autocorrelation describes the correlation between the original and lagged observations of an empirical variable. If residuals show autocorrelation, this is a sign that either the method applied has not been adequate, or the model does not describe the actual series. Residuals should be randomly distributed around zero.

Thus, it was imperative to establish if autocorrelation exists. The results for lag 1 autocorrelation coefficient presented for the different regions are presented in Table 3.

From Tables 2 and 3, the correlation coefficients are positive in all the regions. However, a positive correlation does not necessarily imply causality. Therefore, auto-regressions are run to test causality between the GDP and RE production. A regression on each of the estimated variables on the other and vice versa is conducted. This led to the testing for serial correlation among regression residuals from D–W statistic. The results obtained for the different regions are presented in Table 4.

From Table 4, the regression results indicate that both the regressors have the same explanatory power as revealed in the values of their respective adjusted R^2 values. For example, the common value R^2 for the oil producing block, non-oil producing block, West Africa, East Africa, North Africa, Southern Africa and Central Africa are 0.637, 0.740, 0.157, 0.756, 0.644, 0.471 and 0.717 respectively. Since the D–W test statistic is substantially less than 2, there is evidence of serial correlation among regression residuals.

4. Discussion and concluding remarks

Based on the results examined in Section 3, it can be concluded that there is a general similar pattern on the RE production and GDP over the period under review on the basis of trend, mean, SDV

Table 2
Descriptive statistics and correlation between RE production and GDP for the period 1980–2008.

	RE production		GDP		Pearson correlation coefficient
	Mean	Standard deviation	Mean	Standard deviation	
Africa	65,296.74	16,669.07	582.84	307.69	0.874
Oil producing block	17,649.26	4385.67	221.045	144.06	0.806
Non-oil producing block	47,647.48	12,578.35	361.79	165.91	0.866
West Africa	12,532.00	2936.5	98.94	65.96	0.433
East Africa	7667.79	2615.99	42.67	21.58	0.875
North Africa	13,671.63	2811.88	221.24	120.46	0.811
Southern Africa	20,692.42	8218.51	172.27	72.60	0.700
Central Africa	10,732.89	2564.11	47.72	34.60	0.853

Description: The table depicts the regional variations of the variables based on descriptive statistics (i.e. mean, standard deviation) and correlation between the RE production and GDP over the sample period 1980–2008.

Table 4
Auto-regression results.

Parameters	Regression of GDP on RE production	Regression of RE production on GDP
Oil producing block		
Number of observations	29	29
Dependent variable	GDP	RE production
Independent variable	RE production	GDP
Constant	−246.449	12,222.598
Error	67.917	909.455
Independent variable	0.026	24.550
Error	0.004	3.465
Adjusted R^2	0.637	0.637
Durbin–Watson	0.356	0.342
Non-oil producing block		
Constant	−182.301	23,901.558
Error	62.541	2897.890
Independent variable	0.011	65.634
Error	0.001	7.301
Adjusted R^2	0.740	0.740
Durbin–Watson	0.354	0.359
West Africa		
Constant	−22.961	10,624.539
Error	50.11	913.439
Independent variable	0.010	19.278
Error	0.001	7.722
Adjusted R^2	0.157	0.157
Durbin–Watson	0.137	0.321
East Africa		
Constant	−12.647	3142.266
Error	6.221	538.809
Independent variable	0.007	106.059
Error	0.001	11.309
Adjusted R^2	0.756	0.756
Durbin–Watson	0.394	0.370
North Africa		
Constant	−253.557	9485.233
Error	67.33	659.988
Independent variable	0.035	180,923
Error	0.005	2.630
Adjusted R^2	0.644	0.644
Durbin–Watson	0.432	0.533
Southern Africa		
Constant	44.260	7034.284
Error	26.959	2899.745
Independent variable	0.006	79.268
Error	0.001	15.552
Adjusted R^2	0.471	0.471
Durbin–Watson	0.266	0.296
Central Africa		
Constant	−75.781	7716.76
Error	14.95	436.407
Independent variable	0.012	63.206
Error	0.001	7.449
Adjusted R^2	0.717	0.717
Durbin–Watson	0.320	0.262

Description: The table depicts the regression of RE production on GDP and vice versa computed over the sample period 1980–2008.

and correlation. However, it must also be noted that some few exceptions were noted such as the correlation pattern of North Africa and oil producing block which were slightly different from the other blocks from 1992/1993 onwards. From an application point of view, this is important in making choices for forecasting models that can be used for predictive purposes. It is very easy to choose a forecasting model that can be applied to most of the regional blocks, although not very obvious to find a model that fits all. Furthermore, the correlation between RE production and GDP was positive for all the blocks except the Southern Africa block. What this means from a policy implementation perspective is that perhaps policies should be tailored differently to the Southern Africa block compared to the other blocks. Although the regression residuals were found to be auto-correlated, the direction of causality could not be determined. Therefore as part of future research, a causality test should be performed to test the presence of cause-and-effect relationship of the time series models.

Appendix A. List of different regional blocks in Africa

Geographical classification	Oil-production classification
West Africa	**Oil-producing block**
Benin	Algeria
Burkina Faso	Angola
Cape Verde	Egypt
Cote d'Ivoire	Libya
Gambia	Nigeria
Ghana	
Guinea	**Non-oil-producing block**
Guinea-Bissau	Benin
Liberia	Burkina Faso
Mali	Cape Verde
Mauritania	Cote d'Ivoire
Niger	Gambia
Nigeria	Ghana
Senegal	Guinea
Sierra Leone	Guinea-Bissau
Togo	Liberia
	Mali
North Africa	Mauritania
Algeria	Niger
Egypt	Senegal
Libya	Sierra Leone
Morocco	Togo
Sudan	Morocco
Tunisia	Sudan
	Tunisia
Southern Africa	Botswana
Botswana	Lesotho
Lesotho	Namibia
Namibia	South Africa
South Africa	Swaziland
Swaziland	Mozambique
Mozambique	Madagascar
Madagascar	Malawi
Malawi	Zambia
Zambia	Zimbabwe
Zimbabwe	Central African Republic
	Chad
Central Africa	Congo, DRC
Central African Republic	Congo Brazzaville
Chad	Cameroon
Congo, DRC	Equatorial Guinea
Congo Brazzaville	São Tomé and Príncipe.
Cameroon	Gabon
Equatorial Guinea	Tanzania
São Tomé and Príncipe.	Kenya
Gabon	Uganda
Angola	Rwanda
	Burundi
East Africa	Djibouti
Tanzania	Eritrea
Kenya	Ethiopia
Uganda	Somalia
Rwanda	Comoros
Burundi	Mauritius
Djibouti	Seychelles
Eritrea	
Ethiopia	
Somalia	
Comoros	
Mauritius	
Seychelles	

Description: This appendix shows the list of countries in the different regional blocks of the African continent.

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